Adaptation to various environments and resistance to disease of the Improved Boer goat

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Abstract

The Improved Boer Goat is a remarkable small-stock ruminant that possesses distinctive qualities enabling it to excel as an efficient red meat producer. It is early maturing, reaching a mean maximum weight of \( \approx 62 \) kg at 3.5 years of age on natural pasture under extensive grazing conditions. It boasts high fecundity, with \( \approx 2.09 \) kids born per doe kidded. A relatively large proportion of does (\( \approx 33\% \)) have triplets, whilst the occurrence of kids born as quadruplets and quintuplets have also been documented. The Boer goat is predominantly a browser, enabling it to convert shrub and bush into red meat, thereby playing a supplementary role to other farm stock in increasing meat production per unit area, rather than being in competition with them. As a browser, the goat is also extremely useful and effective in combatting undesirable bush encroachment. In addition, it appears to be fairly resistant towards certain diseases which are normally contracted by other small stock, such as sheep. Lastly, Boer goats produce red meat of high quality which is hardly distinguishable from that of mutton or lamb as far as flavour is concerned, provided animals are slaughtered at a relatively young age. © 2000 Elsevier Science B.V. All rights reserved.

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1. Introduction

The Boer goat (Capra hircus), found in South Africa, consists of a mixture of blood from various goats, principally those imported from the Eastern countries and India. One of the breeds having a definite impact is the milch goat; hence the characteristics of polled animals in certain types, and the ability to produce abundance of milk. The latter is evident in the high growth rate of suckling goat kids (Boer Goat News, 1998).

Five types of Boer goats are found in South Africa, and can be briefly classified as follows (Boer Goat News, 1998):

1. The ordinary Boer goat. It is a short-haired animal which is predominantly found amongst European farmers. It has a fairly good conformation and characteristics, but can be improved upon with regard to conformation, quick growth and uniformity. Colours commonly found are brindle, grey, dark brown and white with occasional brown heads or necks.

2. The long-haired goat is a less desirable type. It is larger and heavier than the Boer goat, and is only ready to be marketed as slaughter stock when
matured. The meat is coarser and the skin worthless due to the long hair.

3. The polled Boer goat is a short-haired goat without horns and with less desired conformation. This goat originated from cross-breeding with the ordinary Boer goat and milch goat types.

4. The Native goat is high on the legs, weak in conformation and varies in colour according to the choice of the tribe.

5. The Improved Boer goat boasts characteristics, such as good conformation, fast-growing kids, high fertility, uniformity with regard to colour and type, hardiness and adaptability. This desired type of Boer goat had its origin in the Eastern Cape of South Africa 60 years ago due to the farsightedness of a number of Boer goat breeders, who started with a definitive breeding policy and with strict selection. Their efforts to breed a better type of goat succeeded, and a Boer goat very near to the ideal has been bred.

The fact that the Improved Boer goat is fairly well-spread throughout South Africa, and further afield, is testimony to the degree of adaptability these animals are capable of. This goat has been exported to various African countries, such as Namibia, Botswana, Zimbabwe and Zambia (Campbell, 1998). Furthermore, it is today found in the United States of America, Canada, Australia and New Zealand (Nicholas, 1998), as well as in Indonesia, Malaysia, Singapore, China, Israel and France (Malan, 1998). According to Muggli (1992), a breed association for Boer goats exists in Germany since 1959.

Boer goats are found on virtually any pasture type, and also excel under intensive conditions, such as cultivated pastures. However, they are predominantly browsers, and thrive on bush and shrub, and are very much at home on rough mountainous terrain where other small stock are not well adapted (Boer Goat News, 1998). It is presumed that the terms hardiness and adaptability were attached to this animal, because of its ability to inhabit this latter environment where management practices such as vaccination and dosing were performed infrequently, whilst relatively high production and reproduction performances were attained under these conditions. In brief, the attributes of the Improved Boer may best be described by the following quotation: “Certainly one of the most hardy of small-stock breeds on earth, with a great ability of adaptation; it is therefore found in such a wide variety of climates and grazing conditions” (The Boer Goat, 1973). It is, henceforth, the purpose of this paper to provide some insight into the special attributes of the Boer goat as an efficient producer of red meat and illuminate other excellent characteristics.

2. Adaptation to environment

It has been reported that between 75 and 80% of the camels, buffalo and goats in developing countries are found in the tropics (Heady, 1983). Another source states that the developing tropical countries have 94% of the world’s goats (FAO, 1980). The vegetation of these areas can be described as tall-grass savanna, grassland, and tropical dry forest (Heady, 1983). In their review of osmoregulation in large herbivores, Maloiy et al. (1979) classed these animals into three main physiological ecotypes, the goat falling into the category of arid zone animals with low rates of energy and water turnover and with medium-to-high urine concentrating ability. Yet, the goat is found under a much wider range of climatic conditions. Apart from thriving in arid desert areas, it is known to succeed in tropical rain forests, being the domesticated animal with the largest ecological distribution (Epstein, 1965).

Although no reference is made to the Boer goat per se in the above literature, it would be correct to assume that this species is perfectly adaptable to similar environments. In South Africa, 50% of the South African goat population is found predominantly in the drier areas of the Eastern Cape province with its indigenous bush and shrub communities. Campbell (1998) describes the contrasting and variable environment in South Africa as follows: “Although extremely beautiful, the natural environment of South Africa is also a cauldron containing a witch’s brew that tests all living organisms to the utmost.” He concluded that these varying but exacting conditions also created the greatest and most beautiful collection of game and indigenous farm animals in the world. The Boer goat is no doubt one of the most outstanding examples of a breed shaped by this environment to be an unsurpassable prolific breeder, yielding red meat of high
nutritional quality even under less favourable conditions. A more in-depth scrutiny of production and reproduction performance bears this out.

2.1. Production performance

Notwithstanding the fact that the Boer goat is generally farmed with under extension conditions in South Africa, this breed is capable of producing offspring with exceptional growth rates. During 1988, the average 100-day weights of performance tested Boer goat kids (corrected for age, multiple birth and rearing effects) were 25.3 kg for male, and 22.3 kg for female kids. During 1996, these figures were 26.9 and 23.4 kg, respectively (Campbell, 1998). It is to be expected that more favourable seasons will have a major beneficial influence on the production parameters such as growth rates.

In a trial conducted in the tropics at the Messina Experimental Farm, various sheep and goat breeds were compared with respect to production parameters during a drought year. Monthly live weights of animals on natural grazing at the end of a 14-month experimental period, relative to values recorded at the onset of investigations, were: Angora goat, 122.3%; Boer goat, 138.8%; Dorper sheep 116.7%; Karakul sheep, 128.7% and Merino sheep, 109.2%. However, their counterparts, receiving a pelleted ration of lucerne (alfalfa) and maize in the ratio of 60:40, recorded relative weights of 125.2; 151.6; 143.8; 154.3 and 147.4 kg, respectively (Hofmeyr et al., 1965). The Boer goat suffered the least weight loss due to unfavourable environmental conditions.

In his study involving three treatments, namely running of cattle alone, a combination of cattle and goats, and goats alone on natural grazing, Els (1995) found that the goats realized the highest meat production in terms of kg live-weight produced per kg live-weight stocked. Meat production for 7 oxen, 6 oxen and 6 goats, and 42 goats totalled 4.92, 5.05 and 10.79 kg/kg, respectively.

On Réunion Island, the indigenous Creole goat was compared with the Boer goat with regard to production and reproduction parameters. Body weights at 7 months of age (slaughter) were 20, 23, 27, 30 and 36 kg, respectively (Kimmes, 1992). From this it may be deduced that the Improved Boer goat has the ability to make a significant contribution towards the improvement of local goat breeds in terms of providing a heavier carcass at slaughtering.

Goats also have a positive effect on production of the natural grazing. In comparison with cattle and cattle/goat treatments, Els (1995) found that the goats alone treatment resulted in the best composition of grass species in the natural grazing. In fact, this was the only treatment boasting an increase in perennial grass species.

2.2. Early maturity

The Improved Boer goat is early maturing, and at the age of 1.5 years, a significant number of ewes produce multiple births; 8% of kids were born as singles, 63.7% as twins, 27.2% as triplets and 1.1% as quadruplets. The mean number of kids born per doe kidded increased from 1.5 years of age to reach the maximum number of 2.09 at the age of 3.5 years (Erasmus et al., 1985). In Namibia, the latter was found to be 1.81 kids at 5 years of age (Els, 1995).

2.3. Reproduction performance

Reproductive fitness may be regarded as the most important criterion relating to adaptation. From the onset of its reproductive life span, the Improved Boer goat has established itself as a most productive and prolific breeder. Mean data from 826 goat does, 1.5–6.5 years of age, revealed that 7.6% of lambs were born as singles, 56.5% as twins, 33.2% as triplets, 2.4% as quadruplets and 0.4% as quintuplets (Erasmus et al., 1985). Interestingly, the Boer goat appears to attain maximum fertility at the relatively early age of 3.5 years; all the quadruplets and quintuplets being born from does at this age. The corresponding weaning percentages in this study were: 7.8, 59.8, 30.3, 1.9 and 0.2% for the respective age groups. In another study, 15.2% of the kids were born as singles, 67.5% as twins, 16.3% as triplets and 0.9% as quadruplets (Els, 1995).

On the other hand, it was reported that Boer goats exported to Réunion Island during 1976–1982 were less productive regarding reproductive performance
when compared to the indigenous Creole goat. Kimmes (1992) found that for Creole, Boer×Creole and Boer goats, litter size averaged 2.28, 1.81 and 1.75 kids, respectively; the conception rate averaged 96, 94 and 90, respectively, and annual kid production per doe averaged 2.57, 1.79 and 1.6, respectively.

2.4. Milk production/weaning weight

The number of kids weaned per doe kidded is an important yardstick to measure maternal characteristics of the goat doe. Having established the fact that high fecundity is one of the Boer goat’s strongest attributes, the conclusion may be drawn that milk production of the doe during the preweaning stage is of utmost importance to enable high growth rates of kids, especially in does having multiple births.

It has been reported that the extent of mammary development in milch goats depends on, amongst others, the number of foeto-placental units and placental weight (Hayden et al., 1979). In addition, the amount of milk produced increases during successive lactations (Prakash et al., 1971). Indeed, in Boer goats, it was found that total milk production in goat does increased with litter size (Ueckermann, 1969; Raats et al., 1983). The latter authors reported a milk yield per day of 1.47, 1.89 and 2.26 l for two-year-old Boer goat does kidding singles, twins and triplets, respectively. The response was less marked in older does; milk production of four-year-old does kidding singles and twins was 1.84 and 1.91 l per day, respectively, whilst in 6-year olds, milk production of 2.09, 2.18 and 2.47 l per day was recorded for singles, twins and triplets, respectively (Raats et al., 1983). The effect of litter size on milk production, thus, diminished as lactation advanced, and this was more marked in old does.

Seasonal influences strongly affect milk production of the doe with regards to multiple born kids. Milk production of the doe with twins decreased from 2.20 in 1982 to 1.52 l per day in 1983 (a drought year). In the case of does with triplets, milk production decreased from 2.03 to 1.41 l per day. However, does with singles were much less subject to environmental feeding stress; milk production decreased from 1.42 to 1.38 l per day (Fourie and Barnard, 1984). These data indicate that a kid born of triplets, consumed 64% less milk than a kid born of twins, and 112% less milk than a kid born as a singleton. Interestingly, mean birth weights of these kids did not differ between the two years (3.9 and 4.0 kg for 1982 and 1983, respectively), but mean 2-month-old weights differed substantially (18.7 and 16.2 kg, respectively), as did the mean daily gains (245 and 203 g per day, respectively) (Fourie and Barnard, 1984). It is thus clear that suckling exerts significant stress on both, the doe and kid, and it is obvious that the managerial programme should be stepped up to focus on the survival and optimal growth of the kids. This viewpoint is shared by Raats et al. (1983), who also referred to the additional stress of the doe with multiple kids having to produce under extensive conditions. It seems logical to assume that the suckling ability of the young kid, together with the amount of milk available for lactation, will also determine the growth rate of the kid.

The mean 150-day corrected weaning weight (corrected weaning weights=actual weaning weights/age in days at weaning×150) over a period of 12 years for all Boer goat kids under extensive conditions in the Eastern Cape of South Africa was 27.72 kg. The highest and lowest weaning weights were recorded in 1981 (34.95 kg) and 1986 (23.19 kg), respectively, whilst weaning weights of 32.95, 28.35, 24.67 and 24.12 kg were reported for kids born as singles, twins, triplets and quadruplets, respectively (Scheltema, 1994).

2.5. Mortalities

Kid mortality amongst kids reared under extensive conditions is relatively high. Erasmus et al. (1985) reported mortality rates of 10.8% for kids born as singles, 8.3% born as twins, 20.8% born as triplets and 31.3% born as quadruplets. Els (1995) also reported that the highest kid mortality took place in kids born as triplets and quadruplets.

The causes of mortalities in small stock vary but, according to Olivier (1980), exposure to cold, shortage of milk of the doe and a too small birth weight of the kid are some of the important factors affecting kid mortality. In spite of the above-mentioned, cognisance should also be taken of the fact that other factors may influence eventual weaning rates. Stock theft as well as predators, especially the black-backed jackal and lynx may contribute substantially toward kid losses.
2.6. The Boer goat as a browser

Bush and shrub encroachment has a significantly detrimental impact on animal production globally. One of the direct consequences may be the rapid deterioration of the natural vegetation, resulting in a decrease in carrying capacity. This, of course, limits red meat production.

Where bush/shrub and grass is available and in free supply, \( \approx 20\% \) of the goats’ diet consists of grass. However, *Acacia karroo* trees have no leaves for three months of the year, thus forcing the goat to subsist entirely on grass during this period (Stuart-Hill, 1987).

In other studies, it was found that goats prefer browsing to grazing at the ratio of 82% bush and 16% grass (Viljoen, 1980). In his study, Aucamp (1979) reported that Boer goats consumed *Portulacaria afra*, other shrubs and grass in the ratio 37:38:25. The Boer goat grazes a wider spectrum of plants than any other type of small stock and are inclined to forage from the top downwards, from \( \approx 160 \) to 10 cm (Aucamp and Du Toit, 1980). This has the advantage that the extremely sensitive ground layer vegetation, including seedlings, young plants and crown plants, is damaged to a lesser degree by this browsing habit of the goats.

On the other hand, it should also be noted that the goat’s adaptive ability should enable it to perform equally well on a grass-only diet (Miller, 1982). Indeed, it has been reported that goats survived where browse had been absent from their diet (Mahmoud, 1978). Results obtained in the Eastern Province False Thornveld (Veld type 21, Acocks, 1988) in South Africa, indicate that grass/bush grazing appeared to be superior to bush-free grazing in terms of chemical composition, but inferior in terms of live-weight gain and mean live weight. However, the high stocking rate in the grass-bush grazing is thought to have been the cause of the latter situation (Nombekela, 1985). Nonetheless, it appears thus that, although the Boer goat is highly regarded as a browser, this animal utilizes significant amount of grass when on grass-bush grazing and, yet, is able to produce satisfactorily on bush-free grazing. Nombekela (1985) reported that goats try to select food with a high quality irrespective of type of forage on offer.

Apart from being a browser, the Boer goat also is a good walker (Roux, 1979) and is able to survive where deterioration of the natural pasture had occurred. This led to the wrong belief that the goat is responsible for the deterioration of natural grazing (Campbell et al., 1962; Corbett, 1978). Aucamp (1979) also warned that the Boer goat possesses the ability to expand and intensify its feeding selection of plant material in overgrazed areas to such an extent that the natural grazing is drastically utilized, with disastrous results. It is thus clear that, as in any other animal husbandry practice, adherence to the correct stocking rate in a stable and balanced ecosystem, will enable the Boer goat to produce optimally.

2.7. Controller of bush encroachment

Bush encroachment impacts negatively on animal production, one of the major effects being the decrease in carrying capacity and deterioration of the natural grazing.

Scott (1970) and Du Toit (1972), both referred to the serious bush encroachment problem in the grassland areas of the Eastern Cape, the most important encroachment problem being the *Acacia karroo* invasion from the adjacent scrub forest or from the Valley Bushveld. Incorporating browsers, such as the Boer goat, falls within the method of biological control of these invading species. Continuous stocking with goats will not eradicate the bush, but will maintain the bush at a minimum density. When the goats are removed, the bush will re-encroach. However, if goat ranching is highly profitable, rotational stocking is applied to maintain the bush in a vigorous and productive state (Trollope et al., 1989).

In his study, Els (1995) reported that the continuous grazing by goats led to the near eradication of feed bushes. In South Africa, the goats are farmed chiefly in areas where thorn trees, such as *Asparagus africanus* and *A. capensis* (Wag’-n-bietjie), *Acacia erioloba* (Camel thorn) and *A. mellifera* (Swarthaak) occur. In an effort to control bush encroachment in the North Western Cape, Boer goat numbers have increased in areas where big and small browsers, such as the eland, kudu, black rhinoceros, impala and steenbok have been partially or totally removed (Campbell, 1977). The Boer goat is suited to these environmental conditions in the sense that they do not get entangled in thorn bushes and shrubs, and need not be protected against rain and cold (Boer Goat News, 1998). Interestingly, it has been reported that in Germany, Boer
goats are popular for landscape maintenance in forest areas because they are less choosy than other goats as regards their diets (Muggli, 1992).

3. Meat quality of the Boer goat

The Boer goat is used in overseas countries to improve growth and meat characteristics in local goat breeds. According to Morand-Fehr et al. (1985), the characteristic low carcass-fat content, particularly of subcutaneous fat, is considered to be less suitable for the purpose of storage and, thus, marketing of the carcass. In an experiment at Hurley, Gibb et al. (1993) reported that Boer goat x British Saanen crosses tended to yield a heavier weight of subcutaneous fat than the British Saanen, and concluded that the use of the Boer sire on the British Saanen dam will allow the production of heavy carcasses from kids not required as dairy replacements. In Germany, where purebred and cross-bred Boer goats are bred for meat, there is a large demand for kid carcasses, weighing 6–8 kg (Muggli, 1992).

According to Casey (1982), two main criticisms have been raised against goat meat. The first is that it is generally regarded as having a stronger flavour than mutton. This may be ascribed to the goat’s habit of browsing leaves from bushes and shrubs containing highly aromatic compounds. However, this is not easily detected between young sheep and goats. The second criticism is that goat meat is tough. Toughening is a real problem due to cold shortening, since goat carcasses have little subcutaneous fat cover. This characteristic of carcass fat has gained the goat the reputation of being thin and having no finish (Casey, 1982).

In a carcass-and-growth characterization study of four South African sheep breeds and the Boer goat, Casey (1982) found that the South African Mutton Merino yielded a carcass with the greatest proportion of muscle, viz. 69.14%, compared with the Dorper (66.01%), Merino (65.23%), Pedi (61.44%) and Boer goat (66.48%). The percentage total carcass fat of 14.12, 19.29, 18.95, 24.75% and 18.24% were recorded for the five breeds, respectively.

4. Resistance towards disease

Relatively little information is available on the Boer goat’s resistance towards disease. However, it is generally believed that Boer goats are regarded as being relatively resistant towards disease (Skinner, 1971). Where good management practices of the natural grazing are applied, it is seldom or ever necessary to dose goats against internal parasites (Boer Goat News, 1998). As firmly established and previously mentioned, the Boer goat is a browser, predominantly feeding on bush and shrubs. It has been found that even under circumstances in which adequate browse is available, ≈20% of the goat’s intake consists of grass (Stuart-Hill, 1987). Another source revealed that browse and grass are ingested in the ratio of 82 and 16%, respectively (Viljoen, 1980). In addition, the Boer goat is inclined to forage from the top downwards, from a height of 160 to 10 cm (Aucamp, 1980a, b). The Boer goat has also been observed climbing trees. These grazing habits of the Boer goat make them less susceptible to parasite infestation which occurs in the grass cover.

According to Steyl (1966), they are a fairly healthy breed, being resistant to such diseases as blue tongue, pulpy kidney (enterotoxaemia) and gall sickness. Pulpy kidney only appears in exceptional cases in Boer goats (Boer Goat News, 1998). However, the development of kids is strongly retarded by internal parasite infestation (Marincowitz, 1986). The control of, especially, Monezia expansa, Avitellina spp. and Thysaniezia giardi in kids is a necessity. Adult goats should receive, at least, one dose of a broad spectrum before autumn and another after the winter to strategically combat Trichostrongylus colubriformis, Haemonchus contortus and Gaigeria pachyscelis (Marincowitz, 1986). It is generally accepted that, because of its hardiness, the goat requires low labour inputs and are easier to manage, thus contributing towards a sustainable economic stock enterprise.

Regarding external parasites, it has been reported that Boer goats are particularly subject to blue tick infestations (Linognathus africanus), especially during the winter and spring (Fourie, 1981). Because lice infestations on kids and young goats retard their development, they should be often monitored to detect infestations.

It has also been reported that the Boer goat is immune to tuberculosis, and, therefore, the advantage of utilizing goat milk is that this disease cannot be contracted by humans (Boer Goat News, 1998). In
fact, it has been claimed that goat milk cures erysipelas (rash) encountered in small children, as well as being prescribed by doctors to cure ‘bawling babies’ (Boer Goat News, 1998).

5. Conclusions

The Improved Boer Goat has many, and great, attributes which make this domesticated animal a much sought-after meat production unit in the international arena. Its ability to produce optimally under a wide range of climatic and production systems, at an early age of 3.5 years, is indicative of this animal’s adaptability, leaving no doubt as to the economic contribution it will make towards a farming enterprise. The goat’s outstanding reproduction potential should be fully utilized in order to increase red meat production of high quality.

Chemical and mechanical control or eradication of bush and shrubs on farm land are expensive, and with no direct financial benefits. It has been shown by numerous authors that the Boer goat is capable of preventing bush encroachment as well as controlling previously infested land, unleashing the potential to markedly increase red meat production off such ‘wastelands’ which would otherwise be useless for animal production. It is envisaged that this animal would make a significant contribution in this regards in foreign countries, such as the United States of America, where, e.g. cedar trees are posing a threat to the natural pastures in the state of Texas. Furthermore, the Boer goat has also been credited with the ability to improve the perennial grass species, resulting in the improvement of the composition of the natural grazing.

The high mortality rates of kids born as triplets and quadruplets in studies completed thus far in South Africa warrants further investigation. In spite of does with three or more kids receiving 1 kg of ewe/lamb cubes in the study of Erasmus et al. (1985), this was insufficient to curb the high kid losses. Although total milk production increases in does with multiple births, individual kids born from multiple births have access to much less milk than their counterparts born as singletons, and studies reveal that this additional milk yield is insufficient to promote optimum growth of such kids under extensive farming conditions. Some data suggest that when principles of good bush and grass community management are applied, satisfactory growth rates may be obtained, even in the presence of less milk production from the doe. However, additional managerial practices should be brought into play to improve the survival rate of kids born from multiple births, especially during less favourable production years. The goal should be to produce healthy strong kids at birth with a strong suckling ability with which the milk production of the doe is utilized to the maximum. Scanning the doe during late pregnancy should identify triplets, quadruplets and quintuplets, affording these the opportunity to receive preferential nutritional treatment pre- and postpartum, as well as being provided with adequate shelter from harsh environmental conditions to significantly increase survival rate of new-born kids and production performance.

The Boer goat has a fecundity of ≈2.3 which is much higher than that of most sheep breeds. This is an indication of the tremendous reproduction potential of the Boer goat and is an important aspect to exploit in goat production to unlatch the great potential for red meat production from these animals.

Although it has been accepted that the Improved Boer goat is relatively resistant towards disease, it should be kept in mind that the intensity at which any disease may occur will vary from region to region. Management procedures of Boer goat flocks may, thus, vary significantly due to different ecosystems.

The Improved Boer goat has been exported to many overseas countries with remarkable success. It is, thus, concluded that the hardy Boer goat, with its high reproduction rate, excellent meat quality and its ability to eradicate or control undesirable bush or shrub, lends itself to be incorporated globally into farming enterprises concerned with optimum production of red meat.

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